RE AD-A262 195 GE

Form Approved
OMB No. 0704-0188

(12)

1. AGENCY USE ONLY

2. REPORT DATE 9 March 93

3. REPORT TYPE AND DATES COVERED Final 1/8/89 - 1/31/92

4. TITLE AND SUBTITLE
Mesoscale Variability off the Calfornia/Baja California Coast Derived from in situ and Satellite Data Using Geographical Information System Technologies

5. FUNDING NUMBERS
N00014-89-J-3181

6. AUTHOR(S)

Dr. James J. Simpson

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Scripps Institution of Oceanography
UC San Diego
La Jolla, CA 92093-0237

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Office of Naval Research
800 N. Quincy Street
Arlington, VA

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES
N/A

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Unclassified, Unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This project identified and located CTD, XBT, and Advanced Very High Resolution Radiometer (AVHRR) satellite data relevant to understanding oceanic processes which controlled mesoscale variability in the temperature, salinity, and density structure of the California Current System from San Francisco to the tip of Baja California. A software system, the CTD Ocean Rendering and Analysis Laboratory (CORAL), was designed and implemented as part of the project to provide efficient data recovery and analysis capability for the data. Five (5) technical papers were written as part of this project. Titles and abstracts for each are given below. A U.S. Naval Officer, Lt. Timothy C. Gallaudet, also earned his Master of Scient in Oceanography as part of this project.

14. SUBJECT TERMS
Geographical information systems; mesoscale variability remote sensing; coastal oceanography

15. NUMBER OF PAGES 6

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL

UNIVERSITY OF CALIFORNIA, SAN DIEGO UCSD

BERKELEY · DAVIS · LOS ANGELES · RIVERSIDE · SAN DIEGO · SAN FRANCISCO SANTA BARBARA · SANTA CRUZ

SCRIPPS INSTITUTION OF OCEANOGRAPHY LA JOLLA, CALIFORNIA 92093

March 9, 1993

To: Office of Naval Research
800 N. Quincy Street
Arlington, VA

From: Dr. James J. Simpson
Mail Stop 0237
Scripps Institution of Oceanography
University of California, San Diego
La Jolla, CA 92093-0237

Subject: Final Report for ONR Grant N00014-89-J-3181: Mesoscale and Large-Scale Variability in California Current System and its Interaction with both California Current and California Undercurrent Flows

ABSTRACT

This project identified and located CTD, XBT, and Advanced Very High Resolution Radiometer (AVHRR) satellite data relevant to understanding oceanic processes which controlled mesoscale variability in the temperature, salinity, and density structure of the California Current System from San Francisco to the tip of Baja California. A software system, the CTD Ocean Rendering and Analysis Laboratory (CORAL), was designed and implemented as part of the project to provide efficient data recovery and analysis capability for the data. Five (5) technical papers were written as part of the project. Titles and abstracts for each are given below. A U.S. Naval Officer, Lt. Timothy C. Gallaudet, also earned his Master of Science in Oceanography as part of this project.

Recurrent Patterns in the Surface Frontal Structure Associated with Cold Filaments Along the West Coast of North America

(Remote Sensing of the Environment, in press)

James T. Randerson

Stanford University, P. O. Box 12610, Stanford, CA 94309

and

James J. Simpson

Scripps Institution of Oceanography, La Jolla, CA 92093-0237

Abstract

Previous studies, based on relatively small volume data sets, indicate that filaments off Northern California have sharp southern (cyclonic) and diffuse northern (anticyclonic) boundaries. In this study, 44 satellite images taken from three coastal regions in the California Current System (Northern, Southern and Baja California) over a period of 10 years were used to quantify the contribution of filaments which exhibit a sharp/diffuse boundary structure to the overall surface frontal structure for a region. The images were specifically chosen from months where past mean wind conditions indicated upwelling occurred because filaments appear to be more abundant during the upwelling season. Distributions of average gradient magnitude as a function of angle were used to provide a more compact representation of the frontal information contained in each image. Principal component analysis of these distributions conclusively demonstrated that filaments exhibiting the sharp/diffuse boundary structure dominate the surface frontal structure during upwelling months in all three regions. Finally, the recurrent, ubiquitous patterns in the satellite-determined frontal structure are discussed in terms of their potential effects on acoustic propagation, water mass transport, ecological community structure and operational fisheries oceanog.aphy in the California Current System.

The CTD Ocean Rendering and Analysis

Laboratory (CORAL)

(J. Oceanic and Atmospheric Technologies, in revision)

James J. Simpson, Jeff Bloom, and Mark A. Botta

Scripps Satellite Oceanography Center, La Jolla, CA 92093

Abstract

The CTD Oceanographic Rendering and Analysis Laboratory (CORAL) is a general purpose X-Window/OSF Motif based platform which encapsulates a set(s) of data and a set(s) of filters for the manipulation of that data. CORAL provides the user with several noteworthy features: 1) a consistent, robust and intuitive graphical interface to a database(s) and its related set(s) of filters; 2) a simplified method for manipulating subsets of data from one or more databases; 3) a high level database interface for acquiring any desired subset of data; and 4) a user-extensible menu system to give maximum flexibility for both the configuration of the menu system and for the analysis and rendering of selected data. CORAL also provides support for the major map projections used today in the earth sciences. Because CORAL can provide support for both regularly and irregularly gridded data, CORAL could be used for calibrating satellite data with ground truth data, as a compute engine for joint remote sensing/in-situ data analysis, and for assembling and analyzing specific subsets of data from large archived databases. Also, because CORAL has fully incorporated the X-Window protocol into its design, it provides a device-independent way for several scientists working on a given project to easily share their data and analyzed results. This paper describes the design, implementation, structure and use of CORAL. Although the version of CORAL described herein encapsulates CTD/hydrographic data and related filters, it is important to emphasize that the underlying CORAL design is sufficiently flexible to include a great variety of other datatypes and corresponding libraries of associated data-specific applications filters.

A Comprehensive Procedure for Correcting Sensor-Induced and Deployment-Induced Errors in CTD Data

(J. Oceanic and Atmospheric Technologies, submitted)

J. Simpson

Scripps Institution of Oceanography, La Jolla, CA 92093-0237

and

N. Larson

Sea-Bird Electronics, Inc., Bellevue, WA 98005-2319

Abstract

Investigators have long identified two basic sources of error in CTD and STD data: 1) errors intrinsic to the sensors and signal acquisition; and 2) errors associated with the deployment of the instrument. In general, deployment-induced errors are the largest source of error in wire-lowered CTD data. Highest quality CTD data require that both types of errors be minimized and that the errors be corrected in an order-dependent way. This paper presents a comprehensive procedure for identifying the major sources of error in CTD data and for making the necessary corrections. Application of this procedure to CTD data taken under different conditions shows the effectiveness of the approach. Issues related to both the land-based and ship-board calibration of the CTD sensors also are discussed within the context of CTD data quality control.

An Empirical Orthogonal Function Analysis Of

Remotely Sensed Sea Surface Temperature Variability And Its Relation To

Interior Oceanic Processes Off Baja California

(Remote Sensing of the Environment, in press)

Timothy C. Gallaudet and James J. Simpson

Digital Image Analysis Laboratory, La Jolla, California 92093-0237

Abstract

Empirical Orthogonal Function (EOF) analysis was applied to a 4.6-year sequence of AVHRR images off Baja California centered near Punta Eugenia to examine large- and mesoscale processes in this region of the California Current System. The mean structure found in the image sequence describes the seasonal cycle in sea surface temperature (SST) and the large-scale, north-south, oceanic SST gradient of the region. The first EOF-amplitude pair also describes the seasonal cycle in SST. Both results are consistent with long-term, large-scale, mean shipboard data for the region. The second EOF-amplitude pair defines two distinct regions paralleling the coast. The inshore region coincides with the *coastal zone* of Lynn and Simpson (1987), and the adjacent region farther offshore is identical to their *transition zone*. The third through fifth EOF-amplitude pairs primarily represent meandering of the California Current and anticyclonic mesoscale eddy occurrences in the region; these results also are consonant with a large number of shipboard observations. The EOF results provide independent satellite-derived evidence for the existence of a transition zone off Baja California which is similar to that found off central and southern California. Moreover, the agreement between the satellite-based results and the shipboard observations indicates that satellite data can be used successfully to study other current systems (e.g., Peru Current) where in situ observations (ships, buoys) are less abundant.

Automated Cloud Screening of AVHRR Imagery

Using Split-and-Merge Clustering

(Remote Sensing of the Environment, 38:77-121, 1991)

Timothy C. Gallaudet and James J. Simpson

Scripps Institution of Oceanography, La Jolla, CA 92093-0237

Abstract

Previous methods to segment clouds from ocean in AVHRR imagery have shown varying degrees of success, with nighttime approaches being the most limited. An improved method of automatic image segmentation, the principal component transformation split-and-merge clustering (PCTSMC) algorithm, is presented and applied to cloud screening of both nighttime and daytime AVHRR data. The method combines spectral differencing, the principal component transformation, and split-and-merge clustering to sample objectively the natural classes in the data. This segmentation method is then augmented by supervised classification techniques to screen clouds from the imagery. Comparisons with other nighttime methods demonstrate its improved capability in this application. The sensitivity of the method to clustering parameters is presented; the results show that the method is insensitive to the split-and-merge thresholds.